Claims

We claim:

1. A transport system for placing a plurality of randomly positioned product on a transporter in a single layer, the transport system comprising:

a first transporter having a first end and a second end and a transport member configured to transport the product from the first end to the second end;

a hopper, the hopper forming a repository proximate the first end of the first transporter, the repository adapted to receive the randomly positioned product;

a drive system coupled to the first transporter and configured to drive the transport member at a transport speed such that at least a portion of the randomly positioned product is moved from the repository towards the second end of the first transporter; and

a control system connected to the drive system, the control system configured to control the transport speed, the control system comprising:

a first sensor positioned to monitor the presence of a first one of the product in an output region proximate to the second end of the transport member; and

a controller connected to first sensor, the controller configured to set the transport speed generally equal to a baseline speed when the first one of the product is detected in the output region and to deviate the transport speed from the baseline speed when the first one of the product is not detected in the output region.

2. The transport system of claim 1, further comprising a product rake configured to block a second one of the product stacked on top of the first one of the product from being transported to the output region.

3. The transport system of claim 1, wherein the second end of the first transporter is elevated relative to the first end of the first transporter.

4. The transport system of claim 2, wherein the second end of the first transporter is elevated relative to the first end of the first transporter.

5. The transport system of claim 1, wherein the controller increases the transport speed from the baseline speed when the first one of the product is not detected in the output region.

6. The transport system of claim 5, wherein the control system further includes a second sensor positioned to monitor the presence of the first one of the product in an input region of the transporter.

7. The transport system of claim 6, wherein the controller decreases the transport speed from the baseline speed when a second one of the product is detected in the output region of the first transporter and the first one of the product is detected in the input region of the transporter.

8. The transport system of claim 1, wherein the baseline speed is determined based on at least one input from the transporter.

9. The transport system of claim 8, wherein the baseline speed is generally equal to a speed of the transporter.

10. The transport system of claim 2, wherein the controller increases the transport speed from the baseline speed when the first one of the product is not detected in the output region.

11. The transport system of claim 2, wherein the control system further includes a second sensor positioned to monitor the presence of the first one of the product in an input region of the transporter.

12. The transport system of claim 11, wherein the controller decreases the transport speed from the baseline speed when a second one of the product is detected in the output region of the transporter and the first one of the product is detected in the input region of the transporter.

13. The transport system of claim 2, wherein the baseline speed is determined based on at least one input from the transporter.

14. The transport system of claim 13, wherein the baseline speed is generally equal to a speed of the transporter.

15. A method of transporting a plurality of randomly positioned product from a hopper to a first region of a transporter, such that the plurality of randomly positioned product is placed on the transporter in a single layer, the method comprising the steps of:

transporting a portion of the plurality of product on a feed transporter from the hopper towards the transporter;

blocking a first one of the portion of the product as it is being transported by the feed transporter such that a single layer of product remains on the feed transporter, the first one of the product being stacked upon a second one of the product;

monitoring the first region of the transporter to determine if a third one of the product is currently present in the first region; and

moving the second one of the product from the feed transporter to the first region of the transporter if the third one of the product is not currently detected in the first region.

16. The method of claim 15, wherein the portion of the plurality of product is transported by the feed transporter at a transport speed based at least in part on a baseline speed of the transporter.

17. The method of claim 16, wherein the step of transporting the portion of the product on the feed transporter includes the step of transporting the portion of the product along an inclined portion of the feed transporter.

18. The method of claim 16, wherein the transport speed is decreased relative to the baseline speed when the third one of the product is detected in the first region of the transporter.

19. The method of claim 16, further comprising the step of monitoring an output region of the feed transporter to determine if the second one of the product is currently present in the output region.

20. The method of claim 19, wherein the transport speed is increased relative to the baseline speed when the second one of the product is not detected in the output region of the feed transporter.

21. A method of controlling the placement of at least one of a plurality of product from a first transporter moving at a transport speed and having an output region to a second transporter moving at a baseline speed and having an input region, the method comprising the steps of:

setting the transport speed generally equal to the baseline speed in the absence of an event;

monitoring at least one of the output region and the input region for the occurrence of an event, wherein an event corresponds to one of the detection of the presence of or absence of a first one of the product in one of the output region of the first transporter and the input region of the second transporter; and

deviating the transport speed from the baseline speed upon a detection of an event.

22. The method of claim 21, wherein a first event corresponds to the detection of the absence of the first one of the product from the output region of the first transporter.

23. The method of claim 22, wherein the transport speed is increased from the baseline speed in response to the detection of the first event.

24. The method of claim 21, wherein a second event corresponds to the detection of the presence of the first one of the product in the output region of the first transporter and the detection of a second one of the product in the input region of the second transporter.

25. The method of claim 24, wherein the transport speed is decreased from the baseline speed in response to the detection of the second event.

26. A transport control system for controlling the placement of at least one of a plurality of product from a first transporter to a second transporter, the first transporter having an output region and a first drive system to drive the first transporter at a transport speed and the second transporter having an input region and a second drive system to drive the second transporter at a baseline speed, the transport control system comprising:

a first sensor configured to detect the presence of the product and positioned to detect the presence of the product within the output region of the first transporter;

a second sensor configured to detect the presence of the product and positioned to detect the presence of the product within the input region of the second transporter; and

a controller connected to the first sensor and the second sensor, the controller configured to control the transport speed of the first transporter based at least on one of a first input signal from the first sensor and a second input signal from the second sensor, wherein the controller increases the transport speed above the baseline speed of the second transporter when the first input signal indicates that a first one of the product is not present in the output region of the first transporter.

27. The transport control system of claim 26, wherein the controller decreases the transport speed below the baseline speed of the second transporter when the first input signal indicates that the first one of the product is present in the output region of the first transporter and the second input signal indicates that a second one of the product is present in the input region of the second transporter.

28. The transport control system of claim 26, wherein the first sensor includes an emitter and a detector configured to detect a signal emitted by the emitter.

29. The transport control system of claim 28, wherein when the first one of the product is within the output region of the first transporter, the signal emitted from the emitter is blocked by the first one of the product from reaching the detector.

30. A transport system for placing a plurality of randomly positioned product onto a transporter, the transport system comprising:

a first transport system configured to receive the randomly positioned product and to organize the randomly positioned product into a single layer, the first transport system having a first end and a second end;

a first product mover configured to move a first portion of the product from the first transport system to the transporter, the first product mover positioned between the first end and the second end of the first transport system;

a second transport system configured to receive a second portion of the product from the first transport system not moved by the first product mover, the second transport system positioned adjacent the second end of the first transport system; and

a second product mover configured to move at least a portion of the second portion of the product from the second transport system to the transporter.

31. The apparatus of claim 30, wherein the first transport system and the second transport system each include a hopper to receive the product.

32. The apparatus of claim 31, wherein the first transport system and the second transport system each further include a product rake configured to block a first instance of the product from being transported to the respective product mover while on top of a second instance of the product.

33. A method for transporting a plurality of randomly positioned product to a transporter, such that each individual product is positioned in a respective tray transported on the transporter, the method comprising the steps of:

receiving a plurality of randomly positioned product;

arranging the product into a single layer;

transporting the product;

moving a first portion of the product to the trays on the transporter;

collecting a second portion of the product;

arranging the second portion of the product into a single layer;

transporting the second portion of the product; and

moving the second portion of the product to the trays on the transporter.

34. The method of claim 33, wherein the step of transporting the product includes the step of transporting the product along an inclined path.

35. The method of claim 33, wherein the second portion of the product is moved to the trays on the transporter at a position spaced apart from where the first portion of the product is moved to the trays on the transporter.